Circular 6146 June, 1929

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DEPARTMENT OF COMMERCE - BUREAU OF MINES

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JUL 22 1929

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EUROPEAN PRACTICE: IV - FRANCE

BY

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SAFEGUARDING ELECTRICAL EQUIPMENT USED IN GASSY MINES [1]
EUROPEAN PRACTICE: IV - FRANCE

By L. C. Ilsley[2]

Cooperation between the United States Bureau of Mines and the Safety in Mines Research Board of Great Britain, continuous since 1924, has made possible this and other papers on safety subjects. Grateful acknowledgment is made to representatives of the board for their assistance in arranging visits to several mine-safety stations, and to F. R. Wynne, Deputy Chief Inspector of Mines, for arranging visits to mines in Great Britain and certain other countries in Europe.

During the summer of 1927 the writer had the privilege of visiting the mine-safety testing stations in Great Britain, Belgium, Germany, and France, in the order named. All of these countries have large coal mines, many of which are rated as gassy. Therefore, when the installation of electrical equipment is contemplated, each of these countries is confronted with the same safety problem as is the United States - that is, the development of electrical equipment that will not ignite gassy atmospheres should they through neglect or accident surround the equipment. The means employed by these countries in safeguarding gassy mines should therefore be of general interest to safety engineers of American coal mines, and a brief survey is given for each of the four countries mentioned. The fourth or last of these surveys covers conditions in France.

REGULATIONS COVERING THE USE OF ELECTRICITY IN FRENCH COAL MINES

The following regulations covering the use of electricity in French mines have been abstracted from the Decree of August 13, 1911, which it is understood is the latest decree bearing on the subject.

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[2] Electrical engineer, U. S. Bureau of Mines.

Gassy Mines:

Article 134

....When portable electric lamps are used, a flame safety lamp is provided for each working place.

Article 216

The use of electricity is forbidden in mines liable to instantaneous outbursts of firedamp, except for portable electric lamps and shot-firing.

In other gassy mines, electrical installations can be made only in the intake air shafts, in landings of these shafts, and in drifts which receive air coming directly from the shaft without first having circulated in any of the working places of the seam, as well as in the immediate vicinity of these landings or drifts.

Armored cables can be placed in the return air of slightly gassy mines with the permission of the district mine authorities.

Article 217

In gassy mines, only blasting machines of a type approved by the Minister of Public Works can be used.

The blasting machines must be sturdily built and maintained in good condition at all times.

Article 218

Except for the rulings of Article 217, it is possible to make use of electric signals or telephones under the following conditions in all parts of gassy mines where tests of the atmosphere, made at least once a day, do not indicate a higher percentage of gas than 0.40

1. Permanent wiring should be installed in armored cable, flexible cables should be protected by flexible conduit.
2. The cables shall be placed as close as possible to the floor and protected against all causes of breakage.
3. Contact points shall be protected by a layer of oil at least 5 centimeters (1.97 inches) deep.
4. Apparatus capable of giving off sparks shall be enclosed in cases capable of resisting an internal explosion of fire damp. These cases must be constructed and maintained in such a way that the ignition can not propagate itself to the external atmosphere.

The use of signals must be stopped immediately if fire damp appears in greater amounts than 0.75 per cent in the vicinity of the installation or at any point along the lines between the installation and the intake air shaft.

Article 219

The installations must be maintained in a good state of insulation.

Insulations in contact with ground shall be checked at least every three months in case of permanent installations and one a month for temporary installations. Insulation between conductors of opposite polarity or different phase shall be checked at least every six months. The results of these checks shall be placed in a log book which shall be open to the mines department at all times.

Defects in insulation must be located and repaired as soon as detected.

Article 220

Temporary wiring and portable motors should be inspected at least once a week.

Nongassy Mines

Since electricity is practically prohibited in the working areas of gassy mines, it should be of interest to study some of the regulations issued in the same decree for nongassy coal mines. Some of the more important regulations follow:.

Article 25

Electrical installations should embody safety devices suitable to the highest voltage existing between the conductors and ground.

Electrical installations are divided into two classes, according to voltage.

First Class

A. Direct Current. - Installations in which the highest normal voltage between conductors and ground does not exceed 600 volts.

B. Alternating Current. - Installations in which the highest effective voltage between conductors and ground does not exceed 150 volts.

Second Class

Installations - d.c. or a.c. - having higher voltages than those mentioned above.

Article 26

Frameworks and driving mechanisms not forming parts of the current path, in machines belonging to electrical systems of the second class should be effectively grounded or effectively insulated from ground. In the latter event the machines shall be surrounded by a platform which shall afford firm footing, shall be insulated from ground and be of sufficient width that it shall not be possible to touch the machine and any grounded body at the same time.

The ground or the electrical insulation must be maintained in good condition at all times.

The same rules hold for transformers serving installations of the second class; apparatus of this kind must be accessible only to those responsible for it.

Article 27

If a machine or an electrical apparatus of the second class is installed temporarily, the part of the premises affected by this machine or apparatus shall be made inaccessible to all but those in charge of it by a guard rail or equivalent device; a sign indicating the danger should be attached in a prominent place.

Article 29

Wiring on switchboards pertaining to systems of the first class should offer insultation and spacing of a character to avoid all danger.

Switchboards carrying apparatus and metallic parts of the second class should have platforms at the front (where the operating handles and instruments are) and be insulated electrically and built like the platforms surrounding machines.

When the metallic parts or apparatus of the second class are erected on the back of the board without protection, an unobstructed passage at least 1 meter (3.28 ft.) wide and 2 meters (6.56 ft.) high shall be maintained behind the aforesaid apparatus and metallic parts; access to this passage shall be by means of a door locked by a key; this door shall only be opened by order of the superintendent or by those authorized by him; entry to it is forbidden to everyone else.

Article 30

Passageways provided for access to unprotected machines and apparatus of the second class can not be less than 2 meters (6.56 ft.) high; their width, measured between the machines, conductors, or apparatus themselves as well as between them and the metallic parts of the building should not be less than 1 meter (3.28 ft.).

Conductors and apparatus of the second class, particularly on switchboards, should be clearly differentiated from others by some obvious marking - a coat of paint, for example.

In places where the floor or the walls are very conductive either by construction or by saline deposits, unprotected conductors or apparatus shall be rendered inaccessible by position.

Article 35

It is expressly forbidden to have work done on lines in the second class without having first disconnected both sides of the section to be repaired. The circuit shall be reestablished only by the express order of the superintendent; the latter shall have first been informed by each of the crew bosses that the work is finished and that the workmen have reassembled at a meeting place previously agreed upon.

All the time the work is going on the break in the line shall be maintained in a manner that the line can not be made alive except by order of the superintendent.

Under exceptional conditions, where public safety requires that work be done on charged lines in the second class, work shall not be started without the express instructions of the superintendent and with all the precautions he shall point out.

Article 37

Telephone, telegraph, or signal lines, particularly in mines having electric installations, affected by the working of the mine which are mounted for the whole distance or any part of it on the same supports as a power line in the second class, are subject to the rules governing installations of the second class.

Their dispatching point, their operating devices, or calling devices should be arranged in such a manner that it is not possible to use or operate them unless they are well insulated with respect to ground unless the devices are arranged in such a way as to insure the insulation of the operator from ground.

Article 38

The user is obliged to set up in a conspicuous place in rooms containing installations of the second class:

1. An official notice indicating "Danger" and expressly forbidding touching metallic parts or conductors subjected to voltage of the second class even with rubber gloves, or to work on these parts or conductors even with tools with insulated handles.
2. Instructions covering first aid to be given to victims of shock, drawn up in a way to conform to the terms which will be established by a decree of the Minister of Public Works.[3]

Article 39

In the two months to follow the promulgation of this regulation, the operator should send to the Chief Engineer of Mines a diagram of his electrical installations of the second class, showing the location of shops, substations, transformer stations, and the wiring.

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[3] This decree has not been issued. It seems that one could substitute therefor the instruction appended to the circular of May 24, 1911, which we give hereafter (p. 181); the two tables it shows, will satisfy practically, if not legally, article 38 of the decree of 1911. (Recueil Des Textes Officiels Relatifs A L'Exploitation Des Mines De Combustibles. 1912 Edition.)

An accompanying statement shall indicate if, in accordance with the articles of this regulation in regard to machines and transformers of the second class, the frameworks and metallic parts, not part of the current path, are insulated electrically from ground or if they are grounded. The same statement shall give the necessary technical information to insure a countercheck on the execution of the provisions of this regulation (kind of current, voltages of the various parts of the installation, etc.).

Within the first 15 days of each year, the diagram and the information accompanying it, if necessary, shall be prepared by the operator and transmitted to the Engineer in Chief of Mines.

In case of important modifications or new installations, the plan and the complementary information shall be submitted to the Engineer in Chief of Mines before starting to put them in service.

Article 80

Locomotive haulage to the interior of the mine and electric haulage are not allowed unless in conformity with instructions, approved by the Engineer in Chief of Mines, governing the conditions of travel of trains and of their personnel.

Article 82

Every hoist installed outside or inside should be provided:

1. With a brake capable of stopping its operation at any position of the hoist and which can function during its operation as well as when stationary, especially in the event of breaking of pipes in fluid motors or interruption to the electric current. The brake shall be capable of being operated by the mechanician immediately and directly from his place of control.

FUTURE PROSPECTS FOR ELECTRICITY IN FRENCH MINES

In a paper delivered during April 1927 before the Society of French Electrical Engineers, M. Etienne Audibert, Engineer in Chief of Mines and Director of the Testing Station of the Central Committee of the Coal Mines of France has given an excellent résumé covering the conditions of electricity in French coal mines and showing in a general way the probable attitude toward the future use of electricity in gassy mines. This paper is too long and comprehensive to quote from at length, but M. Audibert's conclusions which are very interesting are quoted in full in the following:

> I will now conclude in this fashion: There is in existence to-day electrical equipment which may rightly be termed gas-proof. The miners admit its worth, but an unfortunate experience has taught them that the safety is only relative, that certainly apparatus of this type reduce the probability of causing a fire-damp explosion to the minimum but still do

not entirely eliminate it. Look at our flame lamps; gentlemen, for almost a century, hundreds of thousands of workmen have used them in gassy workings; the number of accidents they have caused is infinitesimal in comparison with the number of shifts they have been used. But, still it is not absolutely nil.... The same thing will happen with explosion-proof electrical apparatus. But the least we can do is to surround with all possible precautions the introduction into our working places of equipment which, possibly, might be considered a new cause of fire-damp ignitions. One brief formula appears to me to be able to define the principle of the precautions we must take. It consists in saying that the risk inherent in the use of "safety" electrical equipment may readily be chanced in all cases where the apparatus is installed in working places having a constant air current of appreciable velocity. Therefore we may put motors in haulageways without any hesitation; we can try installing them, but with very much more hesitancy, at working faces or in their immediate vicinity. However, it will be very easy for us to decide, since for French mines, at least, places where electricity can be used to advantage are not often met with.

I think these explanations have made our point of view obvious to you and that you will no longer feel dubious in regard to our needs of electrical equipment. To avoid misunderstanding, I still feel that I should add a further word:

Electricity, as compared with compressed air, has a great advantage in the matter of cost. In a new mine, therefore, it is obvious that one would prefer that its use would be possible every time. The question of its introduction into a mine already equipped with compressed air may possibly appear in a different light, which will vary according to circumstances, depending on whether the compressed-air equipment is already more or less deteriorated and whether a more or less large percentage of it should be kept in service.

In a general way - and with this I will conclude - I ask you, gentlemen, to remember that you will always find the mine operators anxious to study, in collaboration with you, the problems which arise in practice in their workings in regard to the apparatus which you may see fit to design for their use.

VISIT TO FRENCH TESTING STATIONS

On September 10, 1927, accompanied by G. Allsop of the British Safety in Mines Research Station and J. A. B. Horsley, H. M. Electrical Inspector of Mines, Great Britain, the writer had the pleasure of meeting M. Etienne Audibert, Chief Engineer of Mines and Director of the Testing Station of the Central Committee of the Coal Mines of France, at Senlis, his headquarters. Senlis is a small town about one hour's distance by rail from Paris. Director Audibert proved a most genial host to the party, and after discussing mine-safety work, including certain phases of electrical work, made arrangements for a visit to Montlucon on September 12.

Accordingly, on September 12 the same party arrived at Montlucon, about 200 miles south of Paris, where they were met by M. Delmas, M. Audibert's assistant, who treated them with considerate courtesy during their visit to the testing station.

The testing work at Montlucon is carried on at two points not far apart. Research work on pulverized coal is being conducted at one point. The building in which this work was being done was large and roomy and would permit a considerable extension of their work if circumstances should require expansion. The chief item of interest at the other testing station was the facilities for testing electrical equipment, which excelled any other seen in the four countries visited; in fact, the electrical testing equipment was to all purpose a duplicate of the Gallery No. 5 outfit used for testing electrical equipment at the Pittsbu Experiment Station of the Bureau of Mines. It is understood that the French engineers visited other European testing stations and studied other testing outfits in England, Germany, and Belgium before deciding on duplicating the America outfit. Owing to not having working drawings of the gallery, the draftsman maki up the plans for the French outfit apparently made a mistake as to size of shiel for the four observation windows, which have been constructed so small as to render the observation of the actual test somewhat dangerous to the observer.

Testing for Permissibility

At the time of the visit about 35 applications for tests of electrical accessories had been received, and six approvals had been granted. This approva work was for the use of apparatus in potash mines, as electrical-motored equipme had not been admitted to gassy coal mines. At that time both Director Audibert and his assistant, M. Delmas, were hopeful that regulations would soon be issued which would permit the introduction of permissible motors into gassy French mine

TENTATIVE RULES COVERING TESTS OF ELECTRICAL EQUIPMENT FOR GASSY MINES

It is understood that tentative rules have been prepared covering the re quirements of electrical equipment for use in gassy mines and that these regulations are being circulated throughout the industry for criticism.

INVESTIGATION OF ELECTRIC LAMPS

No rules have been published with respect to the requirements for electrical lamps, but M. Delmas in a recent letter has advised that the Commissi of Fire Damp considers the following items with respect to construction of lamps

1. That the lamp is strongly and ruggedly constructed (using "ruggedly" in the ordinary sense).

2. That it is suitably protected against bumps (that is, that the glass guard for the bulb is thick enough--4 or 5 millimeters (0.157 or 0.197 inches)--; that it is covered by a top which projects far enough that it is sufficiently protected against impacts).

3. That the interior of the lamp is sufficiently insulated from the external atmosphere. The approved lamps have three threads in continuous engagement in the locked position. Several lamps have been rejected because the upper threads of the jar were broken by the nick in which the bolt of the magnetic lock falls.

4. That connection is made by screwing and unscrewing and not by means of external parts.

5. Finally, for some months, the Fire Damp Commission requires that the lamps should be furnished with a device assuring instantaneous cutting out of the circuit to the filament in case the protecting glass of the bulb is broken.

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